Actuarial Valuation Report
OF
The Contributory Retirement Systems of
The Commonwealth of Massachusetts

MASSACHUSETTS RETIREMENT LAW COMMISSION

ACTUARIAL VALUATION REPORT
OF
THE CONTRIBUTORY RETIREMENT SYSTEMS OF
COMMONWEALTH OF MASSACHUSETTS

The Commonwealth of Massachusetts
Retirement Law Commission
One Ashburton Place
Boston, Massachusetts 02108

January 5, 1976

To The Honorable Governor, and to the Honorable Senate and House of Representatives.

The Retirement Law Commission submits herewith this report which presents the actuarial valuation of the Contributory Retirement Systems of the Commonwealth of Massachusetts. The report was made possible from the Data Information Bank maintained by the Retirement Law Commission which information was furnished by the Contributory Retirement Systems of the Commonwealth. For convenience, the report has been divided into the following sections:

The actuarial study was prepared by Martin E. Segal Company, Incorporated. Thomas D. Levy, a Fellow of the Society of Actuaries and a Member of the American Academy of Actuaries, prepared the actuarial calculations. Sherman G. Sass and Matthew J. Ryan also participated in the work of Martin E. Segal Company in the preparation of the report.

Respectfully submitted,

Carmen W. Elio, Chairman
William F. Daigle, Vice Chairman
James W. Callanan
Joseph B. Carroll
Bernice E. Ellis
Patrick D. Sullivan
Sidney J. Weiner

December 29, 1975

Massachusetts Retirement Law
    Commission
Boston, Massachusetts 02108

Gentlemen:

We are pleased to submit this report which presents the actuarial
valuation of the Contributory Retirement Systems of the Commonwealth
of Massachusetts.
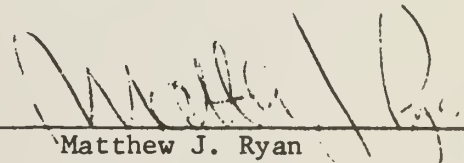
The actuarial calculations were prepared by Thomas D. Levy, F.S.A.,
M.A.A.A., Vice President and Actuary.

We look forward to reviewing this report with you; answering any
questions you may have; and then to assisting you in the presentation
of the report to the Governor and the Legislature.

Sincerely yours,

MARTIN E. SEGAL COMPANY, INCORPORATED

By_____
        Sherman G. Sass
        Senior Vice President

By_____
        Matthew J. Ryan
        Vice President

SGS:jtl

I.   INTRODUCTION AND SUMMARY

This report presents the actuarial valuation of the Commonwealth of Massachusetts Contributory Retirement Systems as of January 1, 1974.

The Massachusetts Retirement Law Commission authorized this actuarial valuation after the Commission had first established the Data Information Bank. The basic employee data and pensioner data for the actuarial studies underlying this report were drawn from this Data Bank - statewide for all 100 systems in operation on the valuation date. The Commission is maintaining this Data Bank so that up-to-date information will be available for continuing actuarial valuations and reports on proposed legislation.

The actuarial costs are presented in Table 1 at the end of Section IV, ACTUARIAL COSTS. Here are the principal cost factors reported in that Section, for all systems as of January 1, 1974.

Item	Amount in millions	% of Pay
Normal cost --		
Total	$ 474	18.8%
Estimated employee		
contributions	125	5.0
Employer normal cost	347	13.8
Actuarial Liability --		
Active members	5,961	
Retired members	2,987	
Total	8,948	
Assets	1,552	
Unfunded actuarial		
liability	7,396	
Total annual employer cost (employer normal cost plus 40 year amortization of unfunded actuarial liability) --		
"Traditional" (normal cost is level percent of pay; amortization is level dollar amount)	811	32.2
"Percent of pay: (normal cost and amortization are level percents of pay)	653	25.9
Total covered annual payroll	2,521	

These costs are presented as the long term, level annual amounts required to be paid by employer contributions in order to meet the ultimate retirement benefits promised by the Contributory Retirement Law. Presenting the costs this way would ordinarily imply a method of funding or budgeting under which the year-to-year appropriations would correspond to these level costs, and would in this way provide advance funding for payments to future pensioners.

Now, in fact, the Massachusetts Contributory Retirement Law does not provide (or permit) such advance funding. Rather the law requires year-to-year budgetary financing. That is, appropriations are made on a pay-as-you-go basis, equal each year to the amount of expected retirement payments in that year less that portion of the benefits that is covered by employee contributions. Currently, employee contributions, on the average, finance from 10 to 15 per cent of the annual retirement benefits paid.

In explaining this presentation of level annual actuarial costs, it will be helpful to start with some of the concepts that are described more fully in Section IV. The Actuarial costs include:

Normal cost - the cost for that portion of the retirement benefit earned in a given year.

Accrued liability - the equivalent of the accumulated costs for all benefits earned in all years before the valuation date.

Unfunded accrued liability - the accrued liability less the accumulated assets, or simply the accumulated costs for all benefits already earned but not yet paid for.

Level annual payment - an amount sufficient to cover both the normal cost and a payment which will amortize the unfunded accrued liability over a certain number of years.

The actuarial costs should be identified and reported, independently of whether the financing of the retirement systems provides for current payments or deferred payments of the costs. The accrued liability is a fair measure of the present value of future benefits already accrued. Again, the normal cost is the measure of the cost attributable to the employee's service in the current year.

These actuarial cost methods, applied to estimate the cost of proposed improvements in the benefit or eligibility rules, also provide realistic long term assessments of these costs; whereas studies which just projected benefit payments on account of the improvements may be misleading in the early years. For example, reducing the minimum service requirement for vesting from 20 years to 10 years will result in a substantial increase in the amount of benefit payments, ultimately. Yet the immediate effect on benefit payments in the early years is negligible because payment of these newly vested benefits is deferred until retirement age, many years in the future. Only the actuarial cost methods will identify the real cost impact.

This report in presenting the level annual actuarial costs will lead to these questions in respect of the funding of the costs which are now identified.

Is reporting the actuarial costs of the present plan and of proposed improvements a sufficient discharge of the governments' responsibility; or

(1) Does prudent planning require anticipating future rising levels of payments by making level annual contributions?

(2) Does fiscal responsibility require paying for pension costs as they are incurred rather than deferring them until the pensions are disbursed, when the costs are borne by a later generation?

(3) Will the reporting of actuarial costs by itself and without the requirements for current funding of the reported costs, have any continuing restraining effect on the legislature as it confronts demands for improvements in benefits?

At the same time as we raise them in this report, the issues are being readied for debate in the Congress. Committee hearings are considering mandatory funding standards for public employee retirement system – whether merely to extend the provisions of the new law for private pension plans or to adopt special requirements for governmental plans.

Without attempting any resolution here in this report of the fundamental policy issue, we offer these summary observations and recommendations to the Retirement Law Commission.

1. A new funding policy should be adopted in Massachusetts.

2. In formulating a funding policy, the first steps should focus on identifying the long term funding objective. That is, there are alternatives methods that should be investigated. Innovative methods, perhaps more appropriate to governmental agencies, should be explored.

3. Once the long term funding objective is identified, the Commission should then study ways of gradually scaling from the present pay-as-you-go level of payments to the new funding level. It may be very important to, Call early attention to this method of transition because of the enormity of the costs reported here compared to the recent levels of appropriation; that is, to explain that there is an alternative to remaining on pay-as-you-go financing other than immediately confronting the full level annual cost in the budget for an early year. And there are precedents for the graduated, stepped schedule in moving toward level cost funding as was done in the U.S. Civil Services retirement system and in several state systems.

II.   BENEFIT PROVISIONS

Public Employees in Massachusetts are not covered by the Federal Social Security System; they receive benefits only under the Contributory Retirement Law. The Main features of that Law are summarized below.

Employee Contributions

Employees hired before January 1, 1975 contribute 5 per cent of their salary; employees hired after that date contribute 7 per cent.

Retirement Benefits

Employees covered by the Contributory Retirement Law are classified into one of four groups depending on job classification. Group 1 comprises most positions in state and local government. It is the general category of public employees. Group 4 comprises mainly police and firefighters. Group 2 is for other specified hazardous occupations. Officers and inspectors of the State Police make up Group 3.

The maximum benefit payable is 80 per cent of a member's final three year average salary. The formula for computing the maximum benefit is different for each group according to the following schedule:

	Group		
Age	1	2	4
65	2.5%	2.5%	2.5%
64	2.4	2.5	2.5
63	2.3	2.5	2.5
62	2.2	2.5	2.5
61	2.1	2.5	2.5
60	2.0	2.5	2.5
59	1.9	2.4	2.5
58	1.8	2.3	2.5
57	1.7	2.2	2.5
56	1.6	2.1	2.5
55	1.5	2.0	2.5
54	1.4	1.4	2.4
53	1.3	1.3	2.3
52	1.2	1.2	2.2
51	1.1	1.1	2.1
50	1.0	1.0	2.0
49	0.9	0.9	1.9
48	0.8	0.8	1.8
47	0.7	0.7	1.7
46	0.6	0.6	1.6
45	0.5	0.5	1.5
44	0.4	0.4	0.4
43	0.3	0.3	0.3
42	0.2	0.2	0.2
41	0.1	0.1	0.1

Group 3 members at age 55 receive 50 per cent of final three year average salary after 20 years of service plus one per cent for each additional year.

Benefits for Group 1

The benefit program provides for voluntary retirement from age 55 to age 70 - the mandatory retirement age for this group. However, members who are younger than age 55 and who have completed 20 years of service are eligible to retire. Veterans receive an extra $15 per year for each year of employment up to a maximum of $300 for 20 or more years of employment.

Benefits for Groups 2 and 4

Members covered by Groups 2 and 4 are subject to a lower mandatory retirement age - 65. The maximum benefit accrual rate of 2.5 per cent begins at age 60 for Group 2 members and at age 55 for Group 4 members.

Disability Benefits

A member who is unable to perform his job due to a non-occupational disability will receive a retirement allowance if he has fifteen years of service (ten if a veteran) and has not reached age 55 of 1.5 per cent of final three year average salary multiplied by years of service. For veterans, there is a minimum benefit of 50 per cent of his most recent year's pay plus an annuity based on his own contributions.

For a job-connected disability the benefit is 72 per cent of the member's most recent annual pay plus additional amounts for surviving children.

Death Benefits

In general, the beneficiary of an employee who dies in active service will receive a refund of the employee's own contributions. If the employee was eligible to retire on the date of his death, a spouse's benefit will be paid based on two-thirds of the amount the employee would have received under Option C. There is also a minimum widow's pension of $140 per month, and there are additional amounts for surviving children.

If an employee's death is job-connected, the spouse will receive
72 per cent of the member's most recent annual pay, plus additional amounts
for surviving children.

Options

Members can elect to receive a full retirement allowance under Option A
that stops at death. Under Option B a member can elect to receive a lower
Monthly allowance in exchange for a guarantee that at death any contributions
not expended for annuity payments will be refunded to his beneficiary. Option
C allows the member to take a lesser retirement allowance in exchange for
providing his survivor with two-thirds of the lesser amount.

Post Retirement Benefits

All of the retirement and survivor benefits are subject to cost-of-living
increases. If the consumer price index changes by 3 per cent or more the
retirement allowance is adjusted by the amount of the CPI increase. This
adjustment only applies to retirement allowances up to $6,000.

III. ACTUARIAL ASSUMPTIONS

The purpose of an actuarial valuation is to determine the employer contributions required to meet the ultimate cost of a retirement system in accordance with a specific funding method. The term "funding method" refers to the budgeting or payment program under which the retirement system is to be financed. Based on the benefit provisions of the system, and on the characteristics of active, inactive and retired members of the system, the actuary makes mathematical calculations to project future benefit payments.

Having determined the liabilities of the retirement system (the current and prospective benefit payments), the actuary then determines the contributions required to accumulate matching assets. The rate at which assets are to be accumulated varies depending on the funding method applied in the actuarial cost calculations.

The term "actuarial valuation" is often used as if it implied a precise and inevitable mathematical result. While it is true that an actuarial valuation involves a good deal of sophisticated mathematics, it also involves a great many variables. The actuary must make his calculations on the basis of a set of actuarial assumptions which have been arrived at following a careful review of the age, service and salary characteristics of active employees; an analysis of hiring and retiring statistics and policies; a full understanding of all of the benefit provisions of the system; and an analysis of past salary increase practices. The actuary also uses an interest rate in his calculations which he believes is likely to be achieved over the long term.

If each of the actuarial assumptions is exactly fulfilled, the actual cost of the retirement system will equal the projected cost. However, this result is rare because of the period of time and the numerous variables involved. Some assumptions may prove to have overestimated the ultimate cost

of the system, while others may understate it. For example, if the invest-
ment earnings on the assets of the system are higher than the assumed rate
of return, the system will receive investment earnings an accumulated assets
that were not taken into account in the actuarial valuation. On the other
hand, if salaries increase more rapidly than projected, actual benefit
obligations may exceed projected obligations.

At the end of this section of the Report there are tables showing the
assumptions used for each of the systems. Here is an explanation of each
of the assumptions:

Mortality

A mortality table is used to project the number of employees at each
age who will die in active service, and also to determine the amount of
the reserve required at the time of retirement to pay benefits for the
remainder of an employee's lifetime. We have used the most recently published
table of pension plan mortality, the Group Annuity Table for 1971, to project
the incidence of deaths among active and retired members.

Disability Rates

For estimating the incidence of disability among active employees, we
have used the tables prepared by the Social Security Administration. For
employees other than Group 4 we assumed that one out of every two retire-
ments on account of disability would be "accidental" (service connected).
For Group 4 employees the factors in the table have been doubled, and we
assumed that nine out of ten disability retirements would be under the
"accidental disability" provisions of the law.

Withdrawal Rates

The withdrawal or turnover rates used in an actuarial valuation are an
important element in the costs of the retirement system because they project
the percentage of employees in various age brackets who will leave the system
without immediate benefit rights (except for the return of contributions).
The employer contributions made to the retirement system during the periods
worked by such employees will be available instead for the payment of benefits
to other members who meet the system's requirements.

Based on our experience with a number of other large public employee retirement systems, we believe that it is appropriate to use different withdrawal rates for safety employees and for all other employees covered by the System.

The withdrawal rates used for State employees and Teachers assume low turnover; for Boston Group 1 and 2 employees, low to moderate turnover; for Group 1 and 2 "Locals", moderate turnover; and for the State Police and Group 4 employees, no turnover was assumed.

Interest Rate

Funding a retirement system on an actuarial reserve basis involves the accumulation of substantial reserves in order to guarantee the fulfillment of benefits provided under the system. These reserves are invested and the rate of long-term investment earnings is a major factor in determining the contributions required to support the ultimate cost of benefits.

While the selection of an interest rate (technically the investment return rate or yield rate) is generally the most important actuarial assumption to be made, the assumed interest rate is not an assumption based exclusively on actuarial considerations. This is because the reported rate of investment earnings depends primarily on the investment policies and asset valuation procedures in effect in a particular retirement system.

The experience of the last several years clearly illustrates that rates of investment earnings can vary widely during relatively short periods. Twenty years ago typical interest rate assumptions used in actuarial valuations were between 2½ per cent and 3 per cent; assumptions of 5 per cent and 6 per cent are common today.

In these calculations we have used 6 per cent as the long-term effective rate of yield on the assets of the retirement systems.

At the same time we believe that the assumed interest rate should bear a reasonable relationship to the assumption made with respect to anticipated increased salary.

Salary Increases

Because the retirement benefits provided by the system are based on an employee's final average salary (three highest years of earnings), increases in salaries have a significant effect on the ultimate cost of the system. For purposes of an actuarial valuation, an assumption is made to estimate the probable salary progression of employees in the future.

The effect of salary increases greater than projected is to produce an actuarial loss, which if not offset by other actuarial gains, results in higher contribution requirements for the future. Selecting a salary increase assumption which approximates actual experience helps to maintain contribution requirements at a level percentage of salary.

The salary scale used in these calculations assumed level increases of 3 per cent per year plus merit increases ranging from 1.8 per cent per year at younger ages to no increases at older ages.

Retirement Age

In terms of cost impact, one of the more important actuarial assumptions is the assumption made with respect to the average age at which employees will retire from service. If it is assumed that employees will retire as soon as they become eligible, the projected cost of the retirement system will be substantially higher than if it is assumed that retirements are deferred for a number of years beyond eligibility. Of course, the ultimate cost of the system will depend on the ages at which employees actually retire from service in the future. To estimate the ultimate cost of the system, an actuary must make an assumption as to the probable incidence of retirements.

Here are the retirement ages we used for the various systems or groups of systems:

State	63
State Police	50
Teachers	63
Boston and Locals:	
Groups 1 and 2	64
Group 4	60

Post-Retirement Increases

Cost-of-living increases have been assumed to average 3 per cent each year.

Valuation of Assets

The assets of the systems were valued in accordance with the statutory provisions of Chapter 32.

Funding Method

The Entry Age Normal Cost method of funding was used. The operation of this method is discussed further in the section on "Actuarial Costs". The basic goal of this method is to spread the cost of each member's benefits as a level percentage of his pay from his date of membership to his projected retirement date.

Inflation

We have included in these calculations an assumption of 3 per cent per year inflation. This is reflected in three of the above assumptions:

Investment yield: Economic studies have indicated a "true underlying interest yield" of about 3 per cent. Adding an inflation allowance, we have used a 6 per cent investment yield.

Salary scale: We have projected salaries by combining a scale based on merit increases and a 3 per cent across-the-board increase each year. The total payroll is therefore projected to increase 3 per cent per year, while the number of employees remains stable.

Post-retirement increases: The inflation assumption is reflected directly in this assumption.

ACTUARIAL ASSUMPTIONS - STATE RETIREMENT SYSTEM

Mortality rates -- Group Annuity Table for 1971.
Termination rates before retirement:

Groups 1, 2 and 4 (Rate %)

Age	Death	Disability	Withdrawal	Total
20	.05	.06	5.39	5.50
25	.06	.09	4.82	4.97
30	.08	.11	3.61	3.80
35	.11	.15	2.23	2.49
40	.16	.22	.94	1.32
45	.29	.36	--	.65
50	.53	.61	--	1.14
55	.85	--	--	.85
60	1.31	--	--	1.31

50% of the disability rates shown represent accidental disability.

State Police (Rate %)

Age	Death	Disability	Withdrawal	Total
20	.05	.06	--	.11
25	.06	.09	--	.15
30	.08	.11	--	.19
35	.11	.15	--	.26
40	.16	.22	--	.38
45	.29	.36	--	.65

90% of the disability rates shown represent accidental disability.

Salary scale:

Age	Present salary as a percent of salary at 65
20	17.45
25	22.07
30	27.76
35	34.62
40	42.68
45	51.76
50	61.77
55	72.98
60	86.08

Includes allowance for inflation of 3% per year.

Post-retirement increases -- 3% per year.
Retirement age -- 63, except 50 for State Police.
Investment Return -- 6%.
Valuation of assets -- At statutory values.

ACTUARIAL ASSUMPTIONS - TEACHERS RETIREMENT SYSTEM

Mortality rates -- Group Annuity Table for 1971.
Termination rates before retirement:

(Rate %)

Age	Death	Disability	Withdrawal	Total
20	.05	.06	5.39	5.50
25	.06	.09	4.82	4.97
30	.08	.11	3.61	3.80
35	.11	.15	2.23	2.49
40	.16	.22	.94	1.32
45	.29	.36	--	.65
50	.53	.61	--	1.14
55	.85	--	--	.85
60	1.31	--	--	1.31

50% of the disability rates shown represent accidental disability.

Salary scale:

Age	Present salary as a percent of salary at 65
20	17.45
25	22.07
30	27.76
35	34.62
40	42.68
45	51.76
50	61.77
55	72.98
60	86.08

Includes allowance for inflation of 3% per year.

Post-retirement increases -- 3% per year.
Retirement age -- 63.
Investment Return -- 6%.
Valuation of assets -- At statutory values.

Table 1c

ACTUARIAL ASSUMPTIONS - BOSTON RETIREMENT SYSTEM

Mortality rates -- Group Annuity Table for 1971.
Termination rates before retirement:

Groups 1 and 2 (Rate %)

Age	Death	Disability	Withdrawal	Total
20	.05	.06	6.53	6.64
25	.06	.09	5.20	5.35
30	.08	.11	4.74	4.93
35	.11	.15	4.35	4.61
40	.16	.22	3.66	4.04
45	.29	.36	2.92	3.57
50	.53	.61	1.04	2.18
55	.85	--	--	.85
60	1.31	--	--	1.31

50% of the disability rates shown represent accidental disability.

Group 4 (Rate %)

Age	Death	Disability	Withdrawal	Total
20	.05	.12	--	.17
25	.06	.17	--	.23
30	.08	.22	--	.30
35	.11	.29	--	.40
40	.16	.44	--	.60
45	.29	.72	--	1.01
50	.53	1.21	--	1.74
55	.85	--	--	.85

90% of the disability rates shown represent accidental disability.

Salary scale:

Age	Present salary as a percent of salary at 65
20	17.45
25	22.07
30	27.76
35	34.62
40	42.68
45	51.76
50	61.77
55	72.98
60	86.08

Includes allowance for inflation of 3% per year.

Post-retirement increases -- 3% per year.
Retirement age -- 64, except 60 for Group 4.
Investment Return -- 6%.
Valuation of assets -- At statutory values.

15.

ACTUARIAL ASSUMPTIONS - LOCAL RETIREMENT SYSTEMS

Mortality rates -- Group Annuity Table for 1971.
Termination rates before retirement:

Groups 1 and 2 (Rate %)

Age	Death	Disability	Withdrawal	Total
20	.05	.06	7.89	8.00
25	.06	.09	7.65	7.80
30	.08	.11	7.13	7.32
35	.11	.15	6.15	6.41
40	.16	.22	4.97	5.35
45	.29	.36	3.68	4.33
50	.53	.61	2.08	3.22
55	.85	--	--	.85
60	1.31	--	--	1.31

50% of the disability rates shown represent accidental disability.

Group 4 (Rate %)

Age	Death	Disability	Withdrawal	Total
20	.05	.12	--	.17
25	.06	.17	--	.23
30	.08	.22	--	.30
35	.11	.29	--	.40
40	.16	.44	--	.60
45	.29	.72	--	1.01
50	.53	1.21	--	1.74
55	.85	--	--	.85

90% of the disability rates shown represent accidental disability.

Salary scale:

Age	Present salary as a percent of salary at 65
20	17.45
25	22.07
30	27.76
35	34.62
40	42.68
45	51.76
50	61.77
55	72.98
60	86.08

Includes allowance for inflation of 3% per year.

Post-retirement increases -- 3% per year.
Retirement age -- 64, except 60 for Group 4.
Investment Return -- 6%.
Valuation of assets -- At statutory values.

IV. ACTUARIAL COSTS

Based on the data provided and the assumptions and methods discussed previously, we performed actuarial calculations to determine the long-term level cost of the Contributory Retirement Law. The results of our study are shown in Table 1. We calculated costs and factors separately for each of the following Systems:

(a) State

(b) Teachers

(c) Boston

(d) Local-In Bank. The ten counties, 65 cities and towns, and one authority which submitted data for the Data Bank.

(e) Local-Not in Bank. The two counties and 19 cities and towns which did not submit data for the Data Bank. Costs were estimated for this group based on the material reported to the Division of Insurance in their annual reports and the assumption that other characteristics were identical to the "Local-In Bank" systems.

The costs are shown in millions of dollars. Because of deficiencies in the data (discussed in Section B), we have referred to the results as "estimated," within about five per cent above or below the figures shown.

The "Normal Cost" is the level percentage of salary required to fund each person's expected retirement benefits from the age at hire (or "entry age") to the assumed retirement age. It is approximately the value of retirement benefits earned this year on account of service rendered this year. The normal cost for a retirement system is the sum of the normal costs for all the covered active employees.

Statewide*, the normal cost is 18.8 per cent of covered payroll -- about $474 million as of January 1, 1974. The employees themselves contribute 5 per cent of their salaries, leaving 13.8 per cent for the various public employers to pay.

_____

* As used here, "statewide" means all 100 retirement systems which were in operation on January 1, 1974.

The "Actuarial Liability" is customarily described as the value of retirement benefits earned by present employees, retirees, and their beneficiaries on account of service prior to the valuation date. Technically, it is the excess of the present value of all future benefits for all active and retired members (whether or not accrued to date) over the present value of future normal costs.

Statewide, the actuarial liability is $5.961 billion for active members and $2.987 for retired members and beneficiaries -- a total of $8.948 billion dollars.

Against this actuarial liability, there are assets totalling $1.552 billion, principally representing accumulated employee contributions.

The "Unfunded Actuarial Liability" is simply the difference between the actuarial liability and the assets. It can be thought of as the value of retirement benefits earned but not yet paid for.

Statewide, the unfunded actuarial liability is $7.396 billion.

At this point, it should be mentioned that it is very uncommon to find a "fully funded plan", i.e., one with no unfunded actuarial liability.

An unfunded actuarial liability generally arises from one of several sources, such as:

(a) Past service benefits. If credit is given for service prior to the existence of a pension plan, then clearly such benefits will not have been funded when they were earned.

(b) Plan amendments. If a change in benefits affects service prior to the date of change, the added benefits will not have been funded when they were earned.

(c) Actuarial losses. If actual experience is less favorable than assumed, then either the liabilities will be greater than anticipated or the assets will be lower, causing an unfunded liability to develop.

(d) Underfunding. If the actuarial costs are not paid as they
    accrue, assets will be lower than anticipated and there
    will be an unfunded liability.

While all of these have occurred in Massachusetts, it is the last one
which distinguishes the Commonwealth's pension postion from other public and
private systems.

The following analogy to buying a house may simplify understanding of
pension costs.

<p align="center">Terminology</p>

Pension plan	House
Normal Cost	Maintenance and taxes
Initial Actuarial Liability	Purchase price
Added Actuarial Liability Due to Amendment	Cost of home improvements
Amortization of Actuarial Liability	Mortgage payment
Unfunded Actuarial Liability	Unpaid principal on mortgage

The plan is set up and credit is given for past service, establishing
an initial actuarial liability. (A house is purchased.) A schedule is set
up to amortize that liability. (A mortgage is acquired, to be paid off over
a fixed number of years). Each year the normal cost (maintenance and taxes)
and amortization payment (mortgage payment) are paid. After a period of time,
the initial accrued liability has been partially paid off, leaving the balance
as an unfunded actuarial liability (unpaid principal on mortgage). Benefit
improvements (home improvements) are made and an added actuarial liability is
established. This is paid off by increasing the amortization payment (increasing
the mortgage payment). Of course, the normal cost (maintenance and taxes)
also increases. Eventually the plan is fully funded. (The mortgage is paid off.)
Then the cost drops to the normal cost (maintenance and taxes) only.

With this as a background, we come to the total annual employer cost --
the actuarial requirement to maintain the systems.

The first decision required is the amortization period (length of the mortgage). We chose forty years -- the longest period acceptable for private pension plans under the Employee Retirement Income Security Act of 1974 (ERISA).

Traditionally (and under ERISA), the unfunded actuarial liability is amortized by level dollar payments (as a house mortgage is paid off by equal monthly payments). The normal cost, however, is a level per cent of payroll, tending to rise with inflation as payrolls rise (just as taxes and maintenance on a house increase with inflation). On this basis, the annual employer cost as of January 1, 1974 is $811 million, or 32.2 per cent of payroll. Over time the amount will rise, but as a per cent of payroll the cost will decline. This is because one component, the amortization payment, does not increase with payroll.

A few public systems use a variation on this procedure. They pay off the actuarial liability by payments which are a level percentage of payroll. Under our assumptions, each year's amortization payment would be three per cent higher than the previous payment. On this basis, the initial annual cost is less -- $653 million or 25.9 per cent of payroll. However, the total cost as a per cent of payroll remains constant (rather than decreasing as in the traditional method), ultimately rising to a higher dollar cost as a result. That is, the "traditional" method costs 32.2 per cent of payroll in the first year, but declines over time to about 19.4 per cent in the fortieth year; while the "per cent of pay" method costs 25.9 per cent of payroll throughout the forty year period.

Table 1

MASSACHUSETTS CONTRIBUTORY RETIREMENT LAW
ESTIMATED ACTUARIAL COSTS AS OF JANUARY 1, 1974
(In millions of dollars. Amounts should be considered to
be within a range of ± 5% from values shown)

ITEM	TOTAL		STATE		TEACHERS		BOSTON		LOCAL–IN BANK		LOCAL–NOT IN BANK	
	Amount	% of Pay	Amount	% of Pay	Amount	% of Pay	Amount	% of Pay	Amount	% of Pay	Amount	% of Pay
Normal Cost --												
Total	$ 474	18.8%	$ 141	21.2%	$ 134	17.1%	$ 52	17.4%	$ 101	19.0%	$ 46	19.2%
Estimated employee contributions	125	5.0	33	5.0	39	5.0	15	5.0	26	5.0	12	5.0
Employer normal cost	347	13.8	107	16.2	95	12.1	37	12.4	74	14.0	34	14.2
Actuarial Liability --												
Active members	5,961		1,157		1,883		890		1,391		640	
Retired members	2,987		686		923		453		623		302	
Total	8,948		1,843		2,806		1,343		2,014		942	
Assets	1,552		451		405		230		319		147	
Unfunded actuarial liability	7,396		1,392		2,401		1,113		1,695		795	
Total annual employer cost (employer normal cost plus 40 year amortization of unfunded actuarial liability) -- "Traditional" (normal cost is level percent of pay; amortization is level dollar amount)	811	32.2	195	29.3	245	31.2	107	35.5	180	34.1	84	35.1
"Percent of pay" (normal cost and amortization are level percents of pay)	653	25.9	165	24.8	194	24.7	83	27.7	144	27.2	67	28.0
Total covered annual payroll	2,521		665		786		301		530		239	

NOTE: Detail figures may not add to totals due to rounding.

21.

V.   EMPLOYEE DATA

The information for this study came from the new Retirement Law Commission Data Bank - and the studies could not have been done without that information. The data was more complete and more reliable than was available for all earlier studies of this type.

The Commission adopted forms and procedures for each Board to furnish pertinent data for all penioners and beneficiaries and for all active members. This body of actuarial employee and pensioner data was never assembled and analyzed before. Any prior studies of estimated actuarial costs were grounded on sample data. Moreover, this Data Bank is being maintained as a prepetual inventory of employee and pensioner information, making it possible to update the actuarial studies and valuations. Finally, the Commission will be able to report separately to each of the Boards participating in the Data Bank, the actuarial cost factors calculated for that Board for the specific data pertinent to that system.

Any new operation of this magnitude can be expected to turn up unforeseen problems. These are outlined below. It should be remembered, however, that in our judgement these are relatively minor. That is, we are satisfied that a 5% margin in the reported figures is sufficient to cover any possible errors introduced by incomplete data.

Category by category, the problems were as follows:

(a) State.   Employees are paid from several sources.
     While many pay checks come directly from the State
     Treasurer, a significant number come from other sources,
     such as the state colleges and institutions. We
     received our data from the Treasurer's Data Center. It
     included only those employees who were members of the
     State Retirement System as of January 1, 1973 and who
     were paid by the State Treasurer's office. This
     included 42,707 employees. Age and service data was

missing for 19,151 of these employee; sex data was
missing for virtually all of them. Salary was not
available for 11,941 employees, principally those
with unknown age and service. As a result, it was
necessary to adjust for missing employees and data,
and we also had to project changes from January 1,
1973 to January 1, 1974. Missing age, service, and
salary data was presumed to be similar to the known
data. Sex was assigned by reviewing the known data
on pensioners who retired in a recent period. Missing
employees were assumed to have the same per cent of
salary cost factors as the included employees. That is,
we were able to determine a total participating payroll
from the annual report of the Board as of December 31,
1972. Since almost all benefits are a direct function
of salary, we increased each cost factor by the ratio
of the total payroll to the payroll included in our
data. Then the projection to January 1, 1974 was made
by reflecting total payroll and total retirement benefit
payment changes for the intervening year.

(b) Teachers. Fairly complete data was available as of
January 1, 1971. However, employees who were members
as of January 1, 1971 but who left teaching in 1971
or 1972 (by death, retirement, resignation, etc.) were
not included. Thus we were left with 58,916 employees.
The only significant missing information was salary for
3,632 members and sex for a substantial number. The
adjustments were essentially the same as for the State
System. Additionally, the Teachers Board annual report
for 1973 had not yet been filed, so we projected assets,
salary and benefit changes for 1973 from the 1971 and
1972 statistics.

23

(c) <u>Boston</u>.   Data was generally good for the 28,434 members
(including 4,137 Group 4 members) as of January 1, 1974.
Age and service data was missing for 6,129 of these
employees, sex was missing for a substantial number,
and salary was unknown for 4,809 members. The adjust-
ments followed those for State employees.

(d) <u>Local-In Bank</u>. Data was submitted on preprinted forms
for ten counties, 65 cities and towns, and one authority
as of January 1, 1974. There was no significant missing
active employee data. The data showed 56,468 active
employees of whom 13,338 were in Group 4. Individual
pension amounts had not been collected since January 1,
1972; changes since then were reflected based on total
benefits as reported in annual reports.

(e) <u>Local-Not In Bank</u>. Data was not received from 21 boards.
Total payroll, retirement benefits, and assets were obtained
from annual reports. Cost factors as a percent of the appro-
priate bases were assumed to be identical to the same ratios
for boards in the Data Bank.

A number of the larger local boards are included in this
category and may have different characteristics than the
included boards. Thus the margin or error is greater for
this category.

Notwithstanding the data problems described, we are satisfied that there
are no drastic errors introduced thereby. That is, we judge that the missing
data is not "biased" in such a way that it is likely to include a dispropor-
tionate number of very low cost or very high cost employees. Therefore, we
have confidence that the results reported reflect, within a reasonable range,
the actuarial position of the various systems under the Contributory Retirement
Law.

*   *   *

The average age and service by category is as follows:

		Average Age	Average Service
(a)	State	42½	7
(b)	Teachers	36½	9
(c)	Boston		
	(i) All groups	42½	11½
	(ii) Group 4 only	45	17
(d)	Local-In Bank		
	(i) All groups	46½	9½
	(ii) Group 4 only	42	13

The above statistics are helpful in explaining differences in cost by system. For example, Teachers and Boston employees are hired at the youngest ages, and so have the lowest normal cost. Likewise, the high service of Boston members confirms the relatively high actuarial liability for that system.

*   *   *

We would like to thank the members and staffs of the participating retirement boards for their help in assembling the data for these studies. (A copy of the data form and instructions follows this section.)

We would also like to thank the staffs of the Treasurer's Data Center and the Division of Insurance for their assistance.

The Commonwealth of Massachusetts

Retirement Law Commission

15 School Street

Boston, Massachusetts 02108

June, 1974

Gentlemen:

At the Spring meeting of the Massachusetts Association of Contributory Retirement Systems, Inc., we explained that the Retirement Law Commission would be requesting information from you in order to establish a data bank of retirement information on public employees working throughout the Commonwealth. The information in the data bank will enable the Retirement Law Commission to study and to report on proposed pension legislation before the General Court, as well as to provide periodic cost analyses to the local Boards on their own experience.

The enclosed forms are to be completed for all <u>active</u> members of your <u>contributory</u> system as of December 31, 1973.

In effect, the forms should include all members on your December 31, 1973 Supplemental Schedule of the Annuity Savings Fund <u>except</u> those who were no longer working for your city, town, or county as of December 31, 1973. (Separate forms will be provided at a later date for certain inactive members whose employment terminated before December 31, 1973. Such inactive employees should be excluded from these lists whether or not they were retired, vested, or received their contributions back.)

Please read the instructions and examples accompanying this letter very carefully. Hopefully, they will answer most of your questions. We recognize that you may not be able to get every piece of information asked for exactly right for every person within a reasonable amount of time. Therefore, we ask only that you do your best to estimate anything that you are unsure of. Leave blank any item for which you cannot make a reasonable estimate.

We look forward to your cooperation and request that the information be returned to the Retirement Law Commission by <u>October 31, 1974</u>. If you have any questions, please do not hesitate to call the Commission office. The number is (617) 227-4087. With your help, we can all do a better job of insuring that the retirement needs of our public employees are adequately met.

Sincerely yours,

Carmen W. Elio
Chairman

INSTRUCTIONS FOR FORM RLC-1-73

Headings: Indicate the name of the board where designated. The three blanks at the left are for the board number shown on the computer printouts distributed at Gardner Auditorium. If you don't know that number, leave it blank and we will fill it in. Indicate whether you are a city or town system or a county system with an X. The "completed by" line should give the name of the person we should contact if we have any questions.

(1) Name: Show last name and first name.

(2) Sex: Indicate "M" or "F".

(3) Social Security Number

(4) Member Number: Leave blank if your system does not assign numbers.

(5) Veteran status: Indicate X for Veterans as defined under the law. Otherwise leave blank.

(6) Retirement group: Enter 1, 2, or 4 as applicable. This should be your best estimate, and can be based simply on the member's present job.

(7) Part time code: Leave blank for 1973 full time employees. Code 1973 part time employees based on the portion of a year's credit that they normally get under your rules, as follows:

1	Under 15%
2	25%-49%
3	50%-74%
4	75%-99%
5	100%

(8) Date of birth: Show month and year only, so March 17, 1924 would be coded as 3/24. These instructions also apply to item (9).

(9) Date of membership: The date membership was effective in your system.

(10) Service: Enter the total full years of credited service (including service under the Special Military Service Fund) in your system only through December 31, 1973. Show 12 years and 8 months as 12, show less than one year as 0, and so forth. These instructions also apply to items (11) and (12).

(11) Purchased service: Includes service transferred, made up or otherwise purchased, whether or not it is fully paid up.

(12) Military service: Include only military service not credited elsewhere (if available). Credit under the Special Military Service Fund should be included in item (10) and excluded here. If you know that there is uncredited military service, but you cannot readily determine how much, indicate an X. Otherwise, leave this item blank.

(13) 1973 Deductions-Regular: This is the total amount of 5% contributions based on 1973 salary only. Payments for purchased service, etc., should be excluded. Show whole dollar amounts only (drop cents) here and in items (15) and (16). Item (13) plus item (15) should equal Column (3) of your 12/31/73 Supplemental Schedule of the Annuity Savings Fund for each individual.

(14) 1973 Deductions-Months: Leave blank for employees who were members the whole year in 1973. For those who contributed for only part of the year, show the number of whole months for which contributions were received. By using items (13) and (14), we should be able to estimate each member's annual rate of pay in 1973.

(15) 1973 Deductions-Extra: Include any payments received by your Board in 1973 but not covered in item (13).

(16) 1973 Deductions-Accum: Enter the total accumulated balance, including interest, as of December 31, 1973. This is column (9) of the 12/31/73 Supplemental Schedule of the Annuity Savings fund for each individual.

(1) Name: Last, First	(2) Sex	(3) Soc.Sec.No.	(4) Member No.	(5) Vet	(6) Ret Grp	(7) P.T. Code	(8) Date of Birth	(9) Memb.	(10) Svc.	(11) Purch	(12) Mil.	(13) Regular	(14) Mos	(15) Extra	(16) Accum.
												1973 Deductions			
1 Example, Abel	M	111-11-1111	11111	X	2		12/26	10/55	18	2	2	500		325	20,124
2 Example, Baker	F	222-22-2222	22222	X	1	3	12/30	5/73	0		X	250	7	210	460
3 Example, Charlie	M	333-33-3333	33333		4		5/44	9/68	5			400			2,379
4															
5															
6															
7															
8															
9															
10															
11															
12															
13															
14															
15															
16															
17															
18															
19															
20															
21															
22															
23															
24															
25															